Aurora Parameterization in the TIE-GCM Model

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HAO
Kp Index and Hemispheric Power (HP)
Data from GUVI: Global Ultraviolet Imager

- Data from 2002-2007
- Average of Northern and Southern hemisphere over all seasons
- Binned with a resolution of 0.5° MLAT and 30 min MLT as a function of Kp index
Thermosphere Ionosphere Electrodynamics General Circulation Model (TIE-GCM)

Auroral Input:  Kp index
Resolution: 5° GLAT x 20 min LT
Auroral Models:

Energy Flux

Half Electron Mean Energy
Plotting the TIE-GCM Model in GUVI Coordinates

Auroral Input: Kp index
Resolution: 1° MLAT x 30 min LT
Auroral Models:

- Energy Flux
- Electron Mean Energy
Energy Flux of the Aurora

Data from GUVI

Kp avg = 1.00  HP = 8.8

Kp avg = 2.99  HP = 29.1

Kp avg = 4.92  HP = 64.6

Kp avg = 6.98  HP = 130.4

TIE-GCM Current Model

Kp = 1.00  Calculated HP = 14.2

Kp = 2.99  Calculated HP = 40.2

Kp = 6.98  Calculated HP = 202.9

Kp = 7.96  Calculated HP = 434.6
TIE-GCM Aurora Parameters

- Radius of the auroral oval
- Center of the auroral oval
- Maximum energy flux on the midnight side and the noon side
- Angular offset of the auroral oval
- Half-width of the aurora
Energy Flux of the Aurora

Data from GUVI

TIE-GCM with New Parameters
Electron Mean Energy

Data from GUVI

Kp avg= 1.00  avg keV= 5.77

Kp avg= 2.99  avg keV= 6.43

Kp avg= 4.92  avg keV= 6.36

Kp avg= 6.98  avg keV= 5.83

TIE-GCM Current Model

Kp= 1.00  avg keV= 3.41

Kp= 2.99  avg keV= 3.42

Kp= 4.92  avg keV= 3.44

Kp= 6.98  avg keV= 3.47
Electron Mean Energy

Data from GUVI

Kp avg = 1.00 avg keV = 5.77

Kp avg = 2.99 avg keV = 6.43

Kp avg = 4.92 avg keV = 6.36

Kp avg = 6.98 avg keV = 5.83

TIE-GCM with New Parameters

Kp = 1.00 avg keV = 5.30

Kp = 2.99 avg keV = 6.10

Kp = 4.92 avg keV = 6.28

Kp = 6.98 avg keV = 6.21
TIE-GCM in Geographic Coordinates with New Parameters
Seasonal Variation: Energy Flux

**GUVI: Summer**

- Kp = 1, HP = 9.51
- Kp = 3, HP = 29.73
- Kp = 5, HP = 66.20
- Kp = 7, HP = 137.34

**GUVI: Winter**

- Kp = 1, HP = 7.51
- Kp = 3, HP = 28.48
- Kp = 5, HP = 64.76
- Kp = 7, HP = 156.43
Summer Energy Flux Max vs. MLT for Kp = 0.20

Summer Energy Flux Max vs. MLT for Kp = 0.99

Summer Energy Flux Max vs. MLT for Kp = 2.00
Seasonal Variation: Energy Flux

TIE-GCM: Summer

- Kp= 1.00, Calculated HP= 9.2
- Kp= 2.99, Calculated HP= 29.3

TIE-GCM: Winter

- Kp= 1.00, Calculated HP= 5.7
- Kp= 2.99, Calculated HP= 24.1
Seasonal Variation: Mean Energy

GUVI: Summer

Kp = 1  avg keV=5.99
Kp = 3  avg keV=6.57
Kp = 5  avg keV=6.30
Kp = 7  avg keV=5.83

GUVI: Winter

Kp = 1  avg keV=5.62
Kp = 3  avg keV=6.42
Kp = 5  avg keV=6.38
Kp = 7  avg keV=6.07